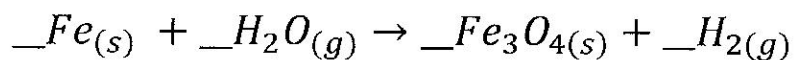


How many liters of oxygen must combine with 1.8 moles of ethane ( $\text{C}_2\text{H}_6$ ) at STP when ethane combusts?

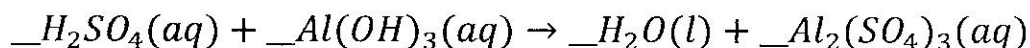
What volume of water vapor is produced at STP when 3 moles of oxygen combine with an excess of hydrogen?

The black oxide of iron,  $\text{Fe}_3\text{O}_4$ , occurs in nature as the mineral magnetite. This substance can also be made in the laboratory by the reaction between red-hot iron and steam according to the following equation.



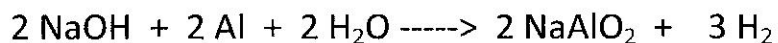
- a. When 36.0 g of  $\text{H}_2\text{O}$  is mixed with 167 g of Fe, which is the limiting reactant?
- b. What mass in grams of black iron oxide is produced?
- c. What mass in grams of excess reactant remains when the reaction is completed?

Sulfuric acid reacts with aluminum hydroxide by double replacement.



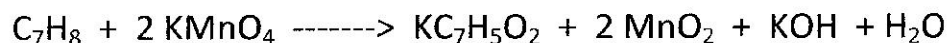
- a. If 30.0 g of sulfuric acid react with 25.0 g of aluminum hydroxide, identify the limiting reactant.
- b. Determine the mass of excess reactant remaining.
- c. Determine the mass aluminum sulfate formed.

Aluminum dissolves in an aqueous solution of NaOH according to the following reaction:



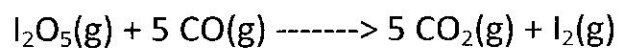
If 85.1g of NaOH reacts with an excess of both aluminum and water, what is the percent yield of H<sub>2</sub> when 5.79g of it is produced in the lab?

Certain salts of benzoic acid have been used as food additives for decades. The potassium salt of benzoic acid, potassium benzoate, can be made by the action of potassium permanganate on toluene.



toluene	potassium
	benzoate

If 106.3g of KMnO<sub>4</sub> is combined with an excess of toluene, what is the percent yield if 42.9g of potassium benzoate are produced in the lab?

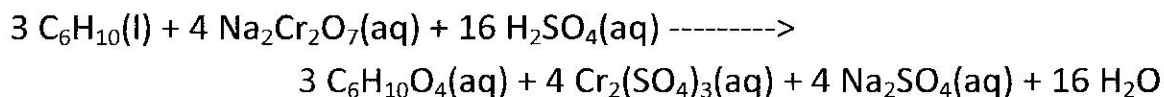


80.0 grams of iodine(V) oxide,  $\text{I}_2\text{O}_5$ , reacts with 28.0 grams of carbon monoxide,  $\text{CO}$ . Only 0.16 moles of iodine was obtained. What is the percent yield of iodine?

1.87 g of Al is reacted with 25.04 g of  $\text{CuSO}_4$ . What is the percent yield of Cu if the actual yield of Cu is 3.74 g?



Adipic acid,  $\text{C}_6\text{H}_{10}\text{O}_4$ , is a raw material for the making of nylon and it can be prepared in the laboratory by the following reaction between cyclohexene,  $\text{C}_6\text{H}_{10}$ , and sodium dichromate,  $\text{Na}_2\text{Cr}_2\text{O}_7$  in sulphuric acid



There are side reactions. These plus losses of product during its purification reduce the overall yield. A typical yield of purified adipic acid is 68.6%.

(a) To prepare 12.5 grams of adipic acid in 68.6% yield requires how many grams of cyclohexene?

(b) The only available supply of sodium dichromate is its dihydrate,  $\text{Na}_2\text{Cr}_2\text{O}_7 \cdot 2\text{H}_2\text{O}$ . (Since the reaction occurs in an aqueous medium, the water in the dihydrate causes no problems, but it does contribute to the mass of what is taken of this reactant). How many grams of this dihydrate are also required in the preparation of 12.5 grams of adipic acid in a yield of 68.6%?